Sports Injuries and Inflammation

OPTIMAL HEALTH SYSTEMS

By Doug Grant and Brian D. Fisher, Ph.D.

Many people believe that the drugs that are most often abused in sports today are anabolic steroids. The fact is that steroids are very dangerous. However, their abuse and overuse is not even close to that of anti-inflammatories.

Anti-inflammatories are often referred to as NSAIDS (non-steroidal anti-inflammatory drugs). They are sold over-the-counter as analgesics, labeled with commonly known brand names such as Motrin, Advil, Aspirin, and Daypro and are also available as prescription-strength anti-inflammatories (eg. Rufen, Indocid, Talacen, Anaprox).

These non-steroidal anti-inflammatory drugs are administered to control acute inflammation and relieve pain. However, with these drugs, this is achieved by inhibiting the production of prostaglandin, a product of arachidonic acid via the cyclo-oxygenase pathway within the cell membrane.

Following the acute inflammatory response a number of prostaglandins are produced, of which prostaglandin E2 (PGE2) is particularly catabolic to muscle and the net result is the loss of muscle protein and atrophy. In addition, another prostaglandin called F2alpha promotes the growth of muscle when this compound acts synergistically with the hormone insulin.

When athletes take these drugs they control inflammation and decrease pain, but the muscle is in a non-regenerative phase.

In other words, by inhibiting prostagladin production, NSAIDS interfere with healing and recovery of the injured muscles.

Finally, several reports have shown that NSAIDs have other detrimental side effects. NSAIDS may damage the liver and kidney and disrupt the mucosal lining of the stomach predisposing to acute gastritis and ulceration (Irvin, Iversen, Roy, 1998).

The purpose of this paper is twofold: (1) to explain the process of inflammation and the effects of NSAIDS on that process, and (2) to explain a safer and more effective way of reducing

inflammation using a powerful natural enzymatic anti-inflammatory (*Optimal Acute* formula from Optimal Health Systems).

THE PROCESS OF INFLAMMATION

The pain, swelling redness and sensation of heat at the injury site that occurs with injury are the result of the body's acute inflammatory response. The activation of the acute inflammatory response following injury involves the amplification and propagation of cells of the reticuloendothelial system (Rubin & Faber, 1996).

The initial events occur within the microvasculature at the level of the capillary and post-capillary venule. Found within this vascular network are the major cellular components of the acute inflammatory reaction; including, basophils, platelets, and circulating monocytes and also blood plasma.

These components are normally contained within the intravascular compartment by a continuous layer of endothelium which is joined by tight junctions and supported by a limiting basement membrane.

Following trauma, the structure of the vascular wall changes, producing a loss of endothelial cell integrity, an escape of plasma and fluid from the intravascular compartment and the extravasation of both white and red cells into the extravascular space (Gallin et al., 1986), resulting in the symptoms described previously.

Following trauma, specific chemical inflammatory mediators are produced at the injury site and these regulate the calibre and permeability of blood vessels in the region (Wollf, 1986).

Of these mediators, vasoactive molecules such as histamine and prostaglandins act directly on the vasculature, producing increased vascular permeability. Chemotactic factors, such as mast cell products, are released and recruit white blood cells from the vasculature into the injury site (Reid, 1992).

Once at the injury site, the white blood cells secrete a number of additional inflammatory mediators, which augment the acute inflammatory response (Arnheim and Prentice, 1993).

Since inflammation is a dynamic occurrence, the reaction, repair and regenerative phases are very gradual and partly overlap.

The speed at which inflammation occurs and is resolved is regulated in the body by hormone-like chemicals called prostaglandins. Simply put, there are both good and bad prostaglandins in the body.

The "bad" prostaglandins(PGE2) stimulate pain receptors, cause pain, and encourage inflammation. The "good" prostaglandins (PGI & F2alpha) decrease the transmission of pain and inhibit inflammation.

The delicate balance that exists between these two groups of prostaglandins (in a healthy body) can be upset when trauma (accident or surgery) or even prolonged stress occurs. In these situations, the body produces large amounts of PGE2, which overwhelm PGI & F2alpha and upsets the functioning of the body's defense mechanisms. No healing can take place until the homeostasis is restored.

Proteolytic enzymes like protease, peptidase and bromelain are "selective prostaglandin inhibitors." They decrease the formation of PGE2 and favor those compounds that turn off the acute inflammatory response. According to Steven Taussig, Ph.D., who has done considerable research on the subject, these proteolytic enzymes do not affect the "good" prostaglandins whose job is to promote the healing process.

In this way, proteolytic enzymes decrease pain and edema that are part of the inflammatory reaction. By reducing PGE2 production to a low level, proteolytic enzymes re-establish the normal ratio between the two groups of prostaglandins in the body. This allows the body's own immune system to return to normal.

Acute trauma, such as strains, bruises, sore muscles and minor surgery all involve the inflammatory process. When using proteolytic enzymes, the symptoms associated with acute inflammation usually subside within five days.

Proteolytic Enzymes Vs. Aspirin and Cortisone

Unlike proteolytic enzymes, which inhibit only the "bad" prostaglandins, aspirin and other non-steroidal anti-inflammatory drugs (NSAIDs) inhibit *all* prostaglandins.

Because these drugs have such a broad effect, even the "good" anti-inflammatory prostaglandins are inhibited. They do this by inhibiting the enzyme, cyclo-oxygenase—the first step in the inflammatory reaction.

Cortisone is also used to fight inflammation, especially in chronic inflammatory conditions, such as arthritis. Cortisone works because it stabilizes the cell membrane and prevents the production of the whole family of prostaglandins. During the inflammatory process, however, production of PGE2 can increase fifty to five hundred-fold.

By inhibiting the release of prostaglandins, cortisone completely suppresses all protein synthesis, placing the wound in a neutral state or a non-healing response. This weakens soft tissue structures and predisposes the tissue to further injury.

In man, a condition known as Cushing's syndrome is caused by excessive amounts of corticosteroids. This results is muscle weakness, atrophy, and death of the muscle fibre.

Cortisone and other corticosteroids suppress the symptoms associated with acute inflammation, but compromise the recovery process.

Athletes are particularly prone to a variety of injuries including sprains and strains, skin abrasions, bruises, hematomas (blood-filled bruises), fractures and dislocations. Even "weekend warriors" are not immune. In fact, muscles, tendons, ligaments and bones that are not conditioned or accustomed to regular exercise, are more likely to be injured when suddenly expected to perform.

One of the best known studies on the use of proteolytic enzymes with athletes was conducted by J. L. Blonstein.

This double-blind study involved 146 boxers with black eyes and with bruises of the lips, ears, chest or arms. Seventy-four of the boxers received proteolytic enzymes (specifically bromelain) and 72 received a placebo until the symptoms disappeared. In 58 of the 74 boxers in the enzyme group, Blonstein found that the black eyes and bruises completely disappeared within four days. Within the same timeframe, only 10 subjects taking the placebo exhibited complete recovery. The enzyme group experienced a more rapid improvement of hematomas and a quicker resolution of complaints.

In a study conducted by Mascetti and Molteni (19XX), of 72 soccer players who had suffered soft tissue injury and skin abrasions, the researchers administered enzymes immediately after injury. The results of the study showed that 80 percent of the cases had more rapid recovery due to the treatment with enzymes.

In addition to anti-inflammatory activity, enzymes can inhibit the formation of blood clots

because of the ability of enzymes to prevent the aggregation of blood platelets. This has been demonstrated *in vitro* by Steven Taussig, as well as *in vivo* by R. M. Heinicke. This could be of particular importance for those individuals prone to clotting problems caused by the stress of exercise. One study showed that blood platelet aggregation increased markedly in athletes during a 400-meter race. For this reason, the ability of enzymes to inhibit platelet aggregation could be beneficial for athletes.

Tarayre and Lauressergues documented significant results in their paper entitled, "The role of protease in reduction of inflammation symptomatology." They reported, "The proteolytic enzymes possess anti-inflammatory properties which have been known for some years now. Furthermore, the therapeutic application of flavonoids and ascorbic acid for their impact on the capillary wall is already a procedure of long standing. The use of proteolytic enzymes by oral route has been controversial, until their absorption was demonstrated. These various compounds have in common the property of acting on the early symptoms of inflammation. The combination studied shows a more general action than that of the non-steroid anti-inflammatory substances and it does not have any side effects."

Deitrick in the Pennsylvania Medical Journal performed a study entitled, "Oral proteolytic enzymes in the treatment of athletic injuries: a double-blind study." "A double-blind placebo controlled study was conducted to determine whether or not a mixture of oral proteolytic enzymes could accelerate the rate of recovery from football injuries. The oral enzyme was shown to produce a statistically significant reduction from the predicted time, compared with placebo.

The results of this study confirm that oral enzymes accelerate healing. In view of these results, we have added oral enzymes as a routine to course of treatment for athletic injuries."

In the *British Journal of Surgery*, Donelly reported that "Proteolytic enzymes (proteases) are the mediators of the body's defense and homeostatic mechanisms. Whilst proteases are known to mediate the majority of biological function their importance in immune systems is often neglected. Studies *in vitro* and *in vivo* have shown that protease of endogenous or exogenous origin can directly alter lymphocyte responses in a dose-dependent manner. Both lymphocytes and macrophages expose cell surface protease in response to antigen and during antibody production."

Fisher and Trethart (1996) report that the combination of proteolytic enzymes and anti-oxidants, when given within the first 24 hours following acute injury has a down-regulating effect on the acute inflammatory response.

This is achieved by the proteolytic enzymes' ability to selectively stimulate the production of the anti-inflammatory prostaglandin E1 and inhibit the synthesis of the pro-inflammatory prostaglandin E2. In addition, anti-oxidants stabilize the blood vessel wall, which in turn decreases the amount of edema present at the injury site.

The pycnogenols act by scavenging oxidants and free radicals, and possess a unique ability to preserve collagen molecules which are a major component of the soft tissue structures and are compromised at the time of injury.

Pilot studies have revealed that when injured football players were treated following competition with the conventional methods of ice or NSAIDs, versus proteolytic enzymes and anti-oxidants, they returned to play with more vigour when treated with the latter combination.

Dr. Tris Trethart found that this combination was extremely useful in the early stages after a sports injury or for persons recovering from surgical procedures. He also found that this combination benefited conditions such as atherosclerosis, back strain, disc pain, sciatica, and whiplash. With these conditions, the management of the inflammatory process with proteolytic enzymes and anti-oxidants may well be the reason for the positive response.

Finally, proteases have been proven effective in viral infections according to Max Wolf, M.D., and Ransberger in their study, "Supplemental protease can raise the proteolytic potential in the blood and the intercellular plasma." This proteolytic activity is then applied as an efficient therapy or prophylactic for viral infection through lysis or inactivation of the viral protein coat.

Successful inhibition of infection has been accomplished in many different viruses including six different influenza type A viruses, polio and other entero-viruses, varicell viruses, vaccinia viruses, herpes zoster, and herpes simplex. "It is known that proteases are able to dissolve almost all native proteins as long as they are not components of living cells. Living, normal cells are protected against lysis by inhibitory mechanism. Virus particles are cell parasites, which in their extra-cellular phase do not show any of the characteristics of life.

Therefore, they cannot in this stage develop any protective inhibitors against proteolytic enzymes. We may conclude that the protein cover of the viruses during their extracellular phase can be dissolved or at least inactivated by proteases. This is bound to result in a loss of infectivity of the virus."

Thus the medical research literature supports the use of a powerful proteolytic enzyme formula

that—if coupled with an effective antioxidant formula—should provide better, safer and more long-term results for the reduction of inflammation and the enhancement of healing. Optimal Acute from Optimal Health Systems has a profoundly powerful proteolytic enzyme/antioxidant formula. In developing this product, the Optimal Health Systems formulators used high levels of protease, peptidase andbromelain which as indicated in the research above act as a powerful anti-inflammatory agent.

Due to the damage caused to cells during inflammation, they have also included whole food antioxidants to help maintain the integrity of the cell wall. The body's most powerful tool to improve cellular integrity due to oxidation is its own Super Oxide Dismutase enzyme (SOD). This enzyme is secreted to take care of the ravages of free radicals like the ones caused by trauma or acute injury. OHS has put a blend of patented minerals in the formula that improves the SOD production in the body greatly enhancing cellular repair.

Also included is Optimal Health Systems' exclusive Opti-Blend™--a unique blend of enzymes and minerals for optimal nutrient delivery making it possible for the nutriments in the formula to be delivered on the cellular level as quick as possible. As the name implies, this formula has been designed to be used immediately after injury in the acute inflammation stages or in any other cases when inflammation is present.

Each capsule contains:
Protease 50,000 HUT
Peptidase 2,500 SPU
Bromelain 250 GDU
Boswellia Extract…..…….70 mg
Vitamin C (from acerola cherry) 10 mg
Wheat germ 25 mg
Zinc (amino acid chelate) 5 mg*
Copper (amino acid chelate) 500 mcg*
Manganese (amino acid chelate) .. 250 mcg*
Opti-Blend™ …….5 mg

Depending on the severity of the injury, take two to four capsules every three hours after injury for the first two days. Then, take two capsules three times a day for the next seven to ten days or until injury is healed.

*Boosts production of SOD (super oxide dismutase), the body's natural antioxidant.

References

Bergkvist, R. "The proteolytic enzymes of Aspergillus oryzae II: properties of the proteolytic enzymes." *Acta Chemie Scandanavia* **17:** 1541-51 (1963).

Bergkvist, R.; Svard, P.O. "Studies on the thrombolytic effect of protease from Aspergillus oryzae." *Acta Physiologie Scandanavia* **60:** 363-71 (1964).

Blonstein, J.L. "Oral enzyme tablets in the treatment of boxing injuries." *The Practitioner* **198:** 547-8 (1967).

Boyne, P.S.; Medhurst, H. "Oral anti-inflammatory enzyme therapy in injuries in professional footballers." *The Practioner* **198:** 543-6 (1967).

Cichoke, A.J. "Systemic Enzyme Therapy." *The American Chiropractic* **13:** 22-3 (1991)

Cleeland, R. *Proceedings of the Society of Experimental Biological Medicine* **112:** 913 (1963).

Cooper, N.R.; Ziccardi, R.J. "The nature and reactions of complement enzymes." In **Proteolysis and Physiological Regulation**, D.W. Ribbons; K. Brew, eds. (New York: Academic Press, 1976).

Deitrick, R.E., MD. "Oral Proteolytic enzymes in the treatment of athletic injuries: a double-blind study." *The Pennsylvania Medical Journal* **68**(10): 35-7 (1965).

Donelly, P.K. et al. "The role of protease in immunoregulation." *British Journal of Surgery* **70:** 614-22, (1983).

Effects of an oral enzyme preparation upon serum proteins associated with injury in man." *Journal of Medicine* (1974).

Fletcher, A.; Alkjaersig, N.K. "Fibrinolytic and Defibrinating Enzymes" in **Enzymes as Drugs**, J.S. Holcenberg; J. Roberts, eds. (New York: John Wiley & Sons, 1981).

Foster, R.L. **The Nature of Enzymology** (London: Croom Helm, 1980). Pp 299-306.

Gsell, O. *Barth-Verlag, Leipsig* (1964).

Hasselberger, F.X. **Uses of Enzymes and Immobilized Enzymes.** (Chicago: Nelson-Hall, 1978). Pp 117-131

Innerfield, I., MD, et al. "Evaluation of an oral proteolytic enzyme in operation upon the hand." *Surgery, Gynecology & Obstetrics* **125:** 595-7 (1967).

Innerfield, I., MD. "Physiological and clinical effects of buccally given proteases." JAMA **170:** 925-9 (1959).

Innerfield, I., MD. **Enzymes in Clinical Medicine** (New York: McGraw-Hall, 1960).

Jelsema, C.L., et al. "Enzymatic Alteration of Cell-Surface Antigenicity" in **Enzymes as Drugs**, J.S. Holcenberg; J. Roberts, eds. (New York: John Wiley & Sons, 1981).

Kiessling, H.; Svensson, R. "Influence of an enzyme from Aspergillus oryzae, Protease I, on some components of the fibrinolytic system." *Acta Chemie Scandanavia* **24:** 569-79 (1970).

Morrison, W.L.; Neurath, H. "Proteolytic enzymes of the formed elements of human blood." *Journal of Biological Chemistry* **20:** 39 (1953).

Rathgeber, W.F., "The use of proteolytic enzymes in sporting injuries." *South African Medical Journal* **45:** 181-3 (1971).

Stuteville, O.H., DDS, MD; Wallach, S, DDS. "Trypsin in the treatment of swellings of the head and neck." *American Journal of Surgery* **96:** 787-91 (1958).

Tarayre, J.P.; Lauressergues, H. "Advantages of a combination of proteolytic enzymes, flavonoids and ascorbic acid in comparison with non-steroid anti-inflammatory agents." *Arzneimittel-Forschung (Drug Research)* **27**(I): 1144-9 (1977).

Thornes, R.D. "Unblocking or activation of the cellulase immune mechanism by induced proteolys in patients with cancer. *Lancet* **2:** 382-4, (1974).

Ulrich, F. "In vitro generation of splenic suppressor cells by trypsin." *Immunology* **46:** 369-80, (1982).

Vanhove, P., etal. "Action of brinase [A. oryzae protease] on human fibrinogen and plasminogen." *Thrombo Haemostas* **42:** 571-81 (1979).

Vischer, T.L. et al. "In vitro stimulation of lymphocytes by neutral proteinases from human polymorphonuclear leukocyte granules. *Journal of Experimentasl Medicine* **144:** 863-72, (1976).
Winsor, T. MD. "Inhibition of the response to thermal injury by oral proteolytic enzyme." *Journal of Clinical Pharmacology* **12:** 325-30 (1972).
Witkin, S.S.; Day, N.K. "Reactions, Regulation and Modulation of the Complement System" in **Enzymes as Drugs**, J.S. Holcenberg; J. Roberts, eds. (New York: John Wiley & Sons, 1981).
Wolf, Max, MD; Ransberger, Karl, PhD. **Enzyme Therapy** (New York: Vantage Press, 1972). Pp.119-34.
Woolf, R.M., MD, et al. "Resolution of an artificially induced hematoma and the influence of a proteolytic enzyme." *The Journal of Trauma* **5**(4): 491-3 (1965).
Young, R.E.S. "Evaluation of oral and parenteral proteolytic enzymes as antiinflammatory agents. *Clinical Medicine* 2461-5 (Nov 1962).
Ashmead HD. Increased superoxide dismutase activity resulting from ingested amino acid chelated menerals. Albion Laboratories, Clearfield, Utah.

OHS™
OPTIMAL HEALTH SYSTEMS

To order Optimal Acute, or for more information about sports nutrition from Optimal Health Systems,
Call (800) 890-4547.

49 S. Sycamore, Ste. 3 · Mesa, AZ 85202
web site: optimalhealthsystems.com
e-mail: info@optimalhealthsystems.com
(602) 890-2221